Blair-An integrated biodiversity monitoring system for Colombia

Mary Blair, Center for Biodiversity & Conservation, American Museum of Natural History

Co-authors: V. Gutierrez-Velez (Temple U.), P.J. Galante, N. Horning, P. Ersts (AMNH), M.E. Aiello-Lammens (Pace U.), P. Jantz (NAU), J.M. Ochoa, M.C. Londoño, B. Gómez-Valencia, C. Correa-Ayram, J. Burbano-Girón, D. López-Lozano, E. Suarez-Valencia, E.A. Noguera-Urbano (I.Humboldt)

1. We aim to advance tools to support and test an integrated biodiversity monitoring system for Colombia's Protected Areas building on current A.50 NASA projects in partnership with the Colombia Biodiversity Observation Network (BON), which have developed:
   - tools for modeling and mapping species distributions
   - decision-support infrastructure and tools related to ecosystem distribution and biodiversity indicators
   - new remote-sensing based datasets on ecosystem structure.
2. By integrating these tools and datasets, we will generate new information on species, community, and ecosystem representativeness and protected area connectivity in Colombia to deliver a dynamically updated information and monitoring system for Colombia's biodiversity.
3. The project will inform key decisions about protected area design and monitoring plan strategies in Colombia towards 2030 biodiversity targets.

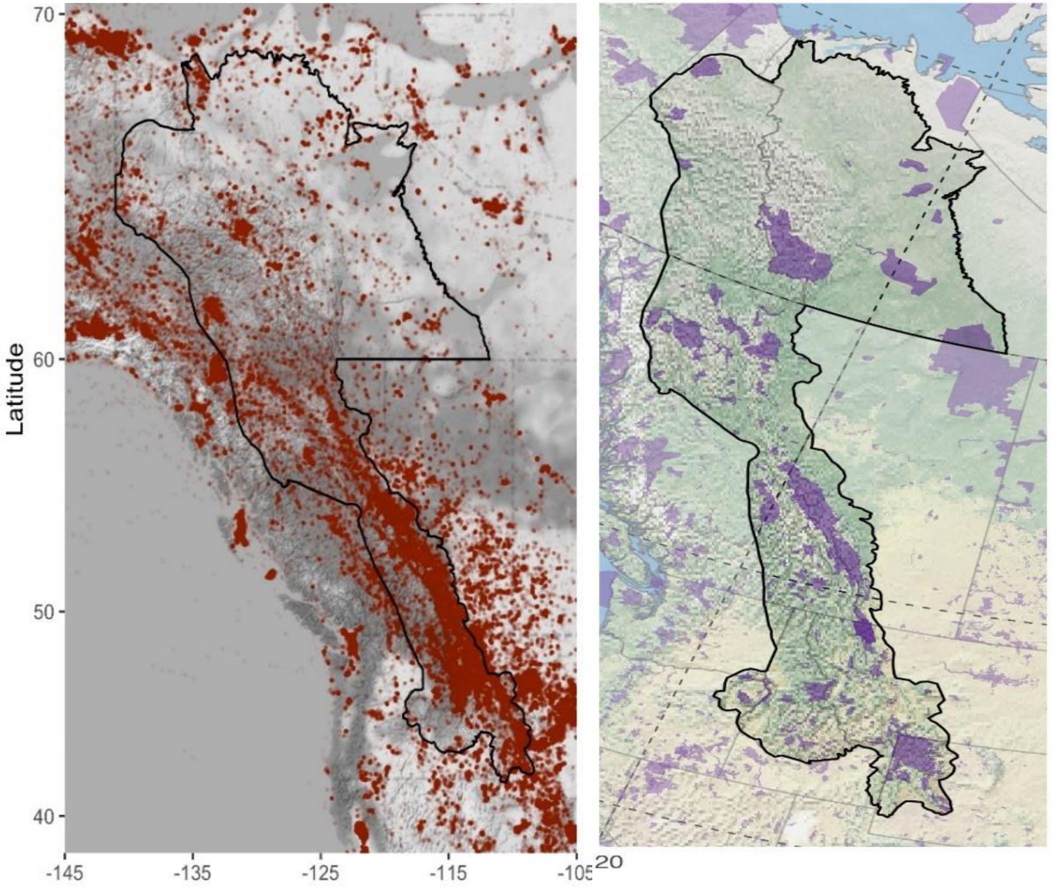
Bohrer – *Forecasting Tools for theY2Y Migration Corridor*

Gil Bohrer, The Ohio State University

Roland keys, John Fieberg, Sarah Davidson, Ashley Lohr, Martin Wikelski

Yukon to Yellowstone (Y2Y) migration corridor

Observed animal locations in a shared archive, conservation areas



Workflow of ecological forecasting apps, to analyze movement and remote-sensing data

Will service the 2Y2 end user coalition – government, NGO and University users

MOVEstore

Configure Movebank Datasource

Movebank Login · Studies · Animals · Options · Overview

1 Download Data

4 Visualize Results

Move Store

SARAH DAVIDSON

Workflows

Applications

Cloud Storage

Documentation

Golden eagles

Y2Y Segmentation Example

START WORKFLOW

Movebank

thindata-byti...

segmentdata-bys...

points-on-m...

2 Thin Data

3 Classify and Segment

thindata-bytime

HISTORY · CANCEL · SAVE CONFIGURATION

segmentdata-byspeed

Minimim movement speed defining migration

Insert minimum speed (in m/s)

16

HISTORY · CANCEL · SAVE CONFIGURATION

Brandt–Integrating Remote Sensing and Ecological Forecasting into Decision Support for Beaver Rewilding

Jodi Brandt, Boise State University
Co-I's: Nancy Glenn, Joe Wheaton, Philip Bailey, Wally Macfarlane, Nick Kolarik

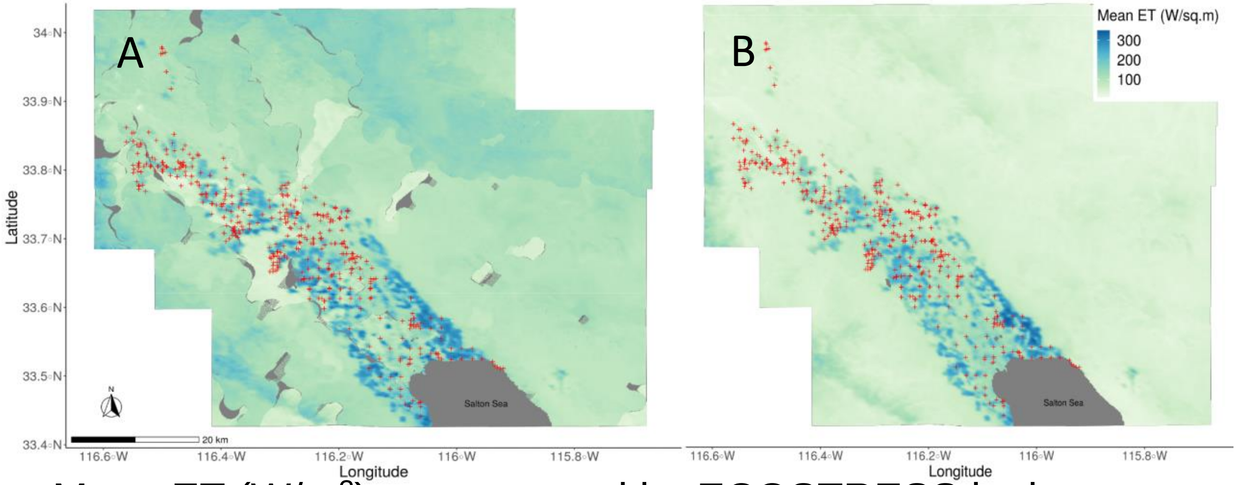
1. **Beaver Restoration Assessment Tool (BRAT):** Predicts restoration potential
2. **Mesic Resource Restoration Monitoring aid (MRRMaid):** Monitors restoration process (Sentinel, Landsat, NISAR)
3. **Citizen Beaver:** Photo App for repeat photos and beaver sightings

DeFelice–Environmetally informed West Nile virus forecasts

Nicholas DeFelice, Icahn School of Medicine at Mount Sinai

M. Sorek-Hamer, M. Ward, K. Vemuri, S. Campbell, J. Henke, C. Romano, M. Santoriello

- West Nile virus transmission is driven by an enzootic cycle between mosquito vectors and bird hosts
- Identifying the key environmental conditions that facilitate and accelerate this cycle can be used to inform effective vector control
- Statistical models using GRIDMET data, 4km resolution, show dry winter followed by warm spring are associated with an increase in mosquito infection rates
- ECOSTRESS has potential to identify hydrologically rich areas where mosquitoes and birds interact during a warm spring following a dry winter

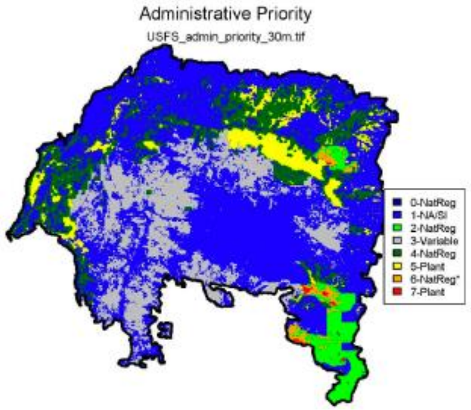


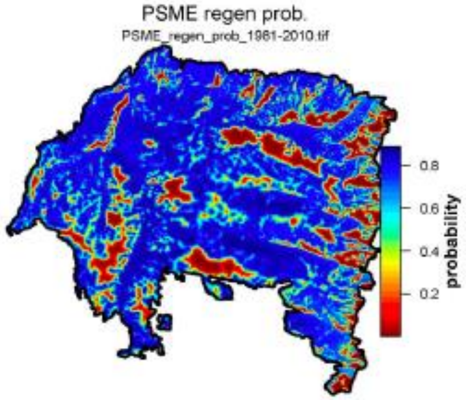
Mean ET (W/m^2) as measured by ECOSTRESS in the Coachella Valley, CA during the early season (Figure A: March - May) and late season (Figure B: June - Aug) with trap locations (red x) for 2019.

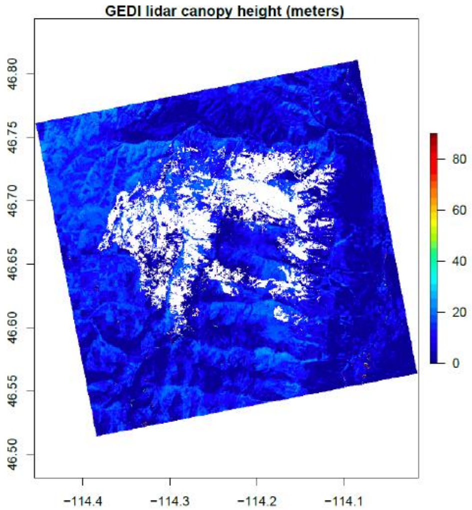
Dobrowski–Decision Support for Post-Fire Forest Restoration

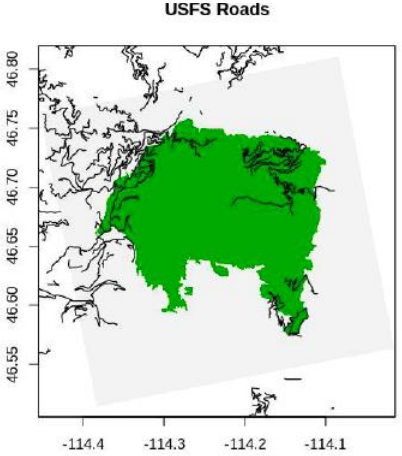
Solomon Dobrowski, University of Montana

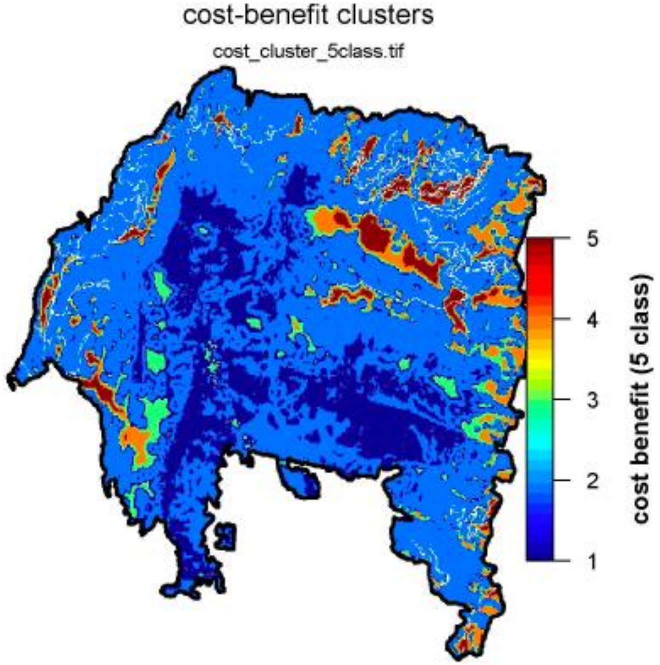
Marco Maneta, Zach Holden, Drew Lyons, Zach Hoylman











UNIVERSITY OF MONTANA

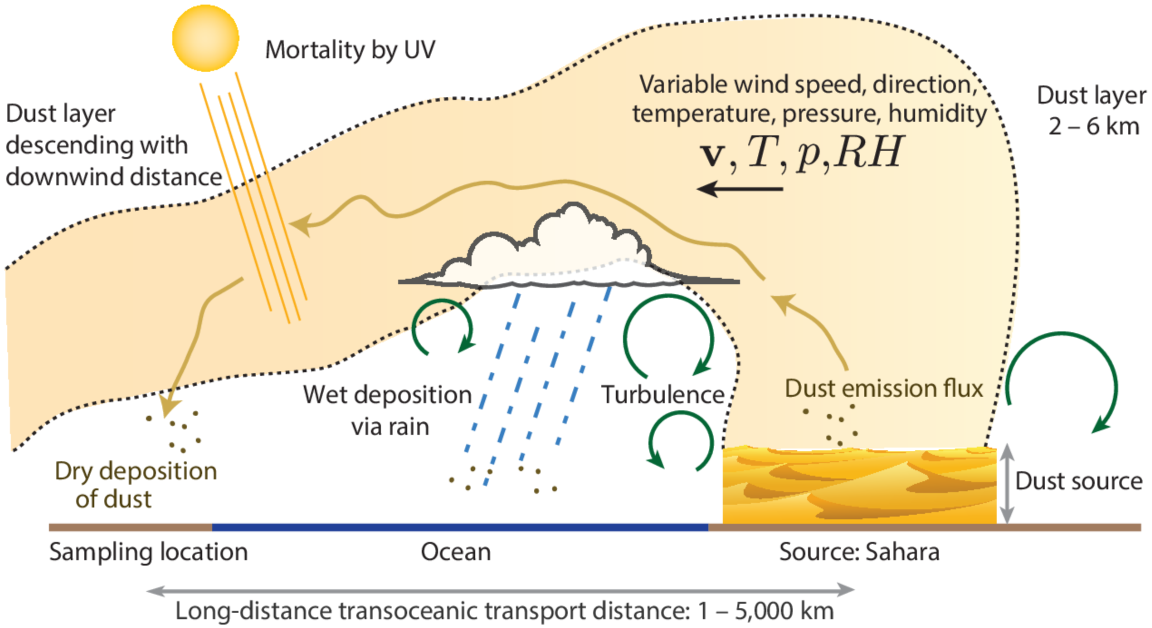
W.A. FRANKE COLLEGE OF FORESTRY AND CONSERVATION

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

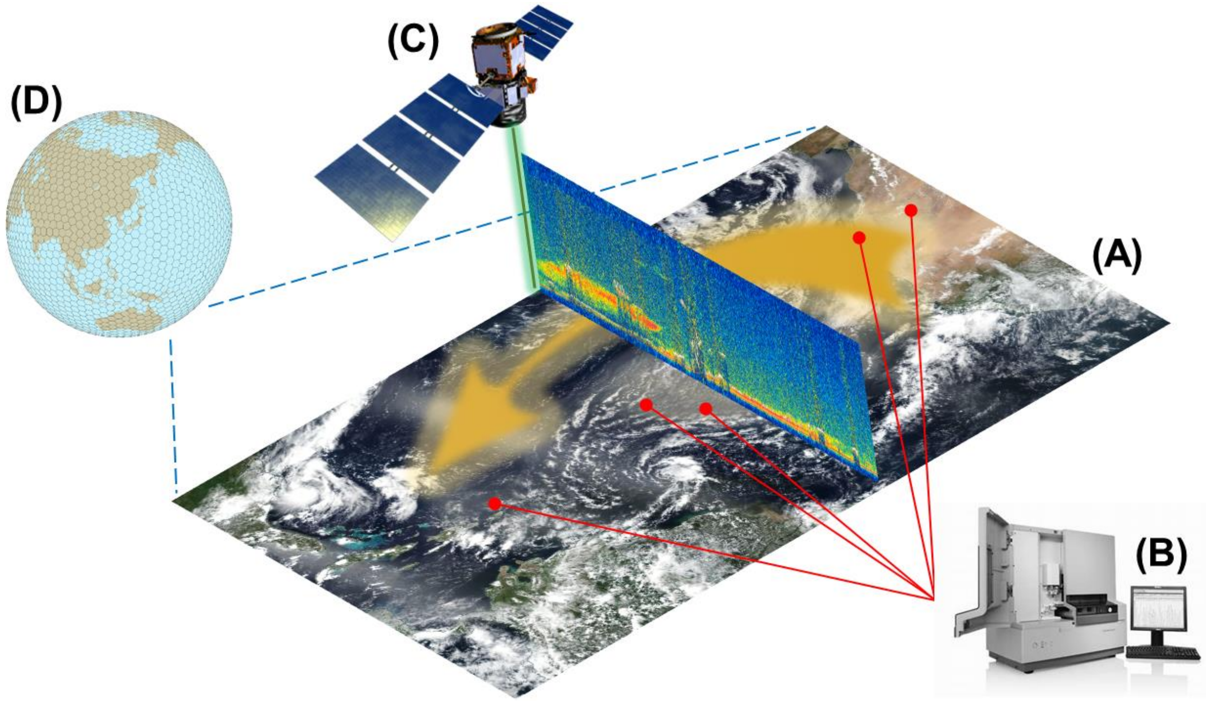
Foroutan–Microbial Biodiversity in Trans-Atlantic Dust Plumes

Hosein Foroutan, Virginia Tech

David Schmale, VT; Shane Ross, VT; Dale Griffin, USGS; Cristina Gonzalez-Martin, ULL



A schematic diagram summarizing the processes affecting microbial diversity of dust plumes



Trans-Atlantic plumes of dust aerosols and microbes (A) are synergistically studied using microbiological analysis of several available samples previously collected across the Atlantic (B), satellite products (C), and atmospheric Lagrangian transport and data-driven models (D).

Gutierrez–Integrating Earth Observations for biodiversity decisions

Victor Hugo Gutierrez-Velez[1], Maria C. Londoño[2], Wilson Lara[1], Ivan Gonzalez, Daniel Lopez[2], Erica Suarez[2], Jeronimo Rodriguez[1]

[1] Temple University, [2] Institute von Humboldt

1. We present an integrated system that harnesses the potential of national and global Earth Observation products to inform decisions on biodiversity management and planning.
2. The system combines:
   - a **cloud data catalog and processing infrastructure** that harmonizes both national and global products to produce SBI derived from EBVs.
   - a user-friendly **graphical interface** that assists decision-makers and other relevant stakeholders to retrieve spatial EBV products and indicators.
   - a suite of **software applications** that streamlines the production of workflows and new spatial data products with the potential to further expand the functionality of the system.
3. The system allows for scalability as new data and applications are developed and also portability that makes it adaptable to other other BONs worldwide.

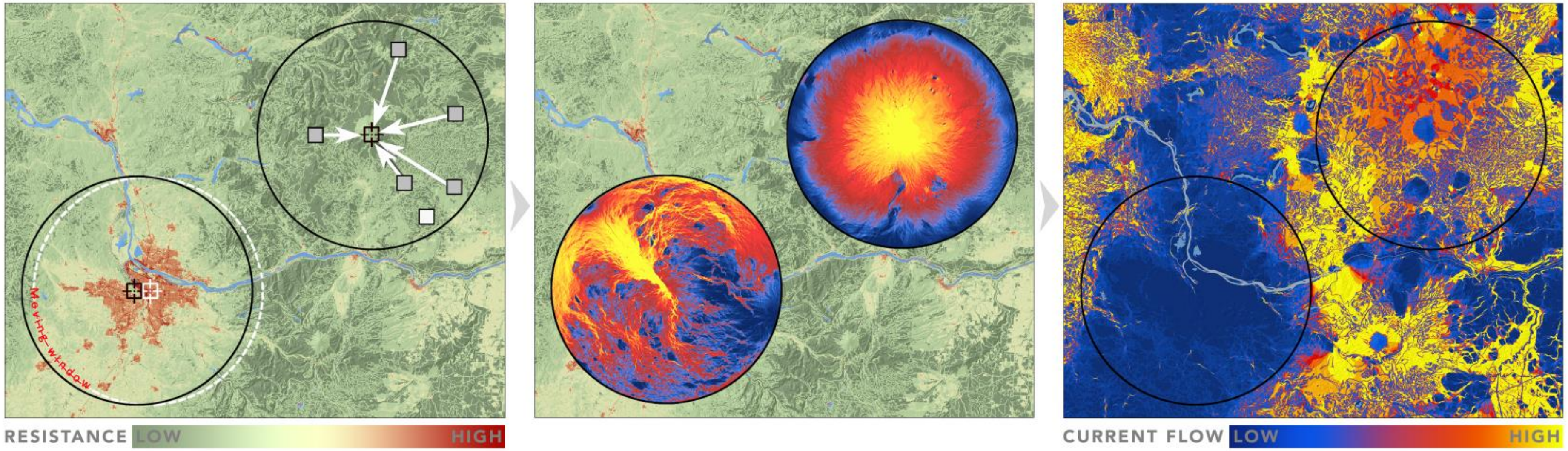
rsensus
Remote Sensing & Sustainability

INSTITUTO HUMBOLDT COLOMBIA

Hall – Circuitscape & Omniscape in Julia

Kimberly Hall, The Nature Conservancy;
Viral Shah, Julia Computing; Ranjan Anantharaman, MIT;
Vincent Landau, Conservation Science Partners

Brad McRae
1966-2017

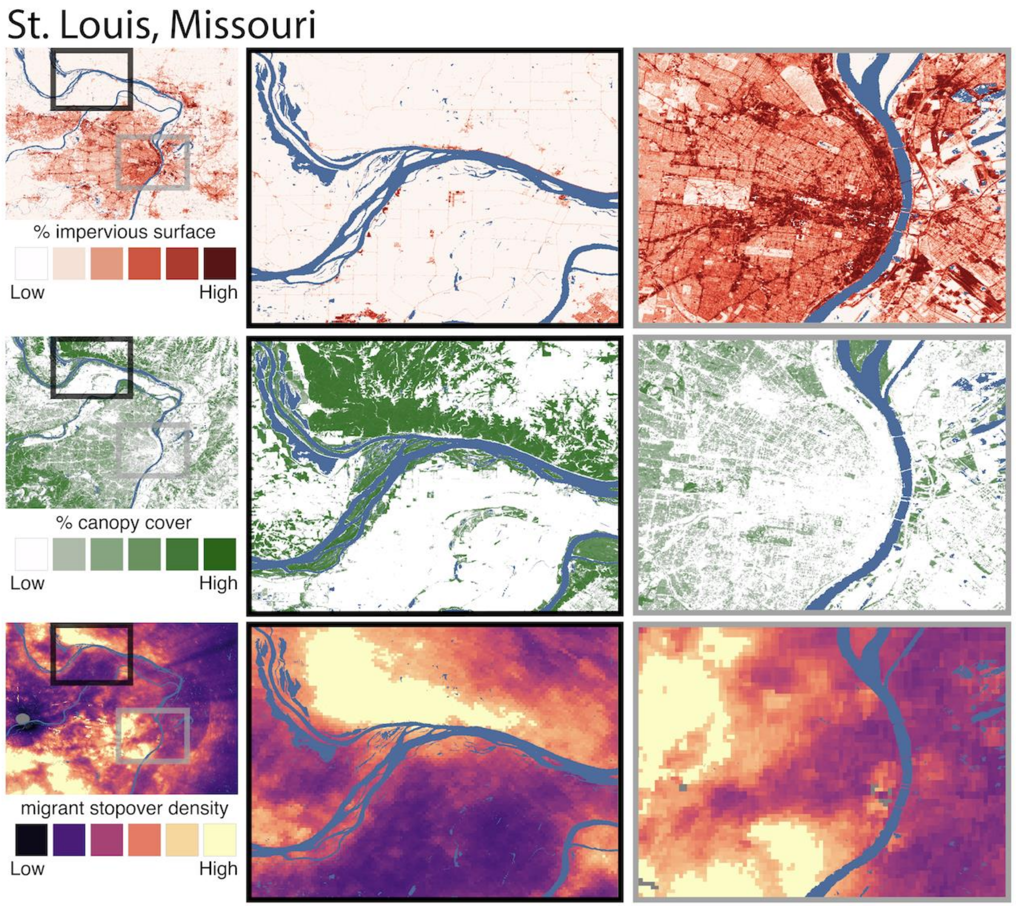


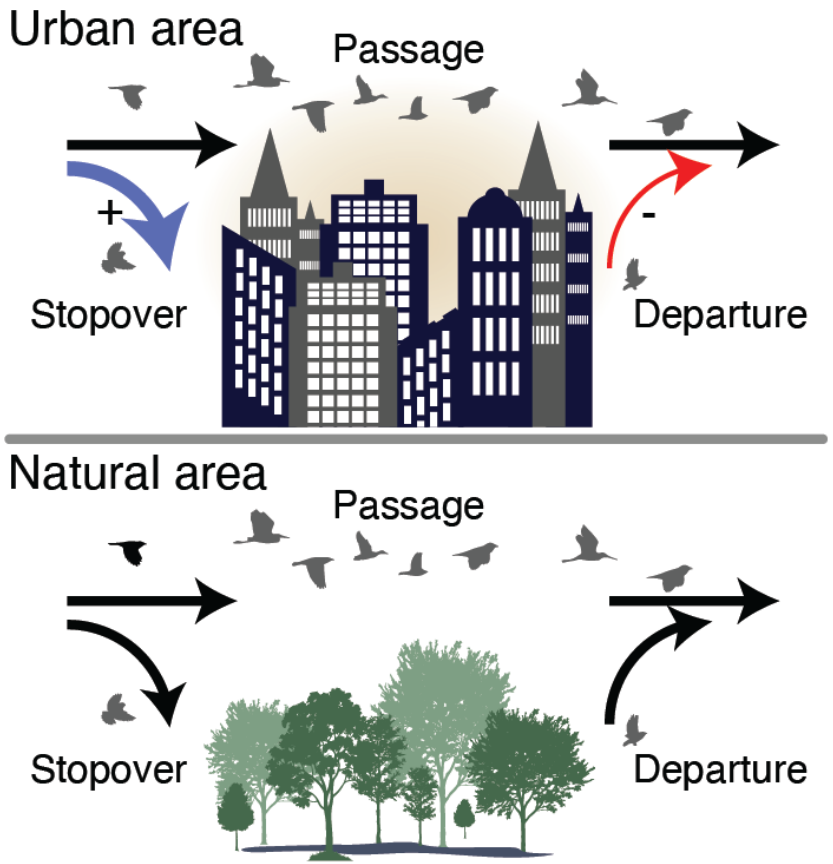
The Nature Conservancy
Julia computing
Conservation Science Partners

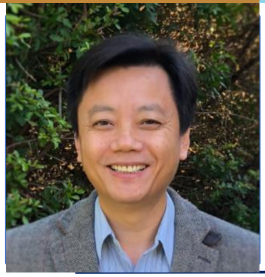
- We re-coded McRae & Shah's widely-used Circuitscape software in the high-performance Julia language, and created an open source, fast version of McRae's Omniscape, a very flexible tool for landscape & climate connectivity modeling using Earth observation datasets. See https://github.com/Circuitscape
- Our NASA-funded work on software is complete, and we are continuing to build support materials and new functionality.
- Our in-progress and proposed applications focus on identifying key places to ***restore*** to increase connectivity, and development of tools and workflows to facilitate dynamic connectivity models, e.g., using a time series of EO data. We welcome opportunities to collaborate!

Horton – Understanding urban centers as ecological traps

Kyle G. Horton, Colorado State University
Geoffrey M. Henebry, Michigan State University







Hu–*Sargassum* monitoring and forecasting

Chuanmin Hu, University of South Florida

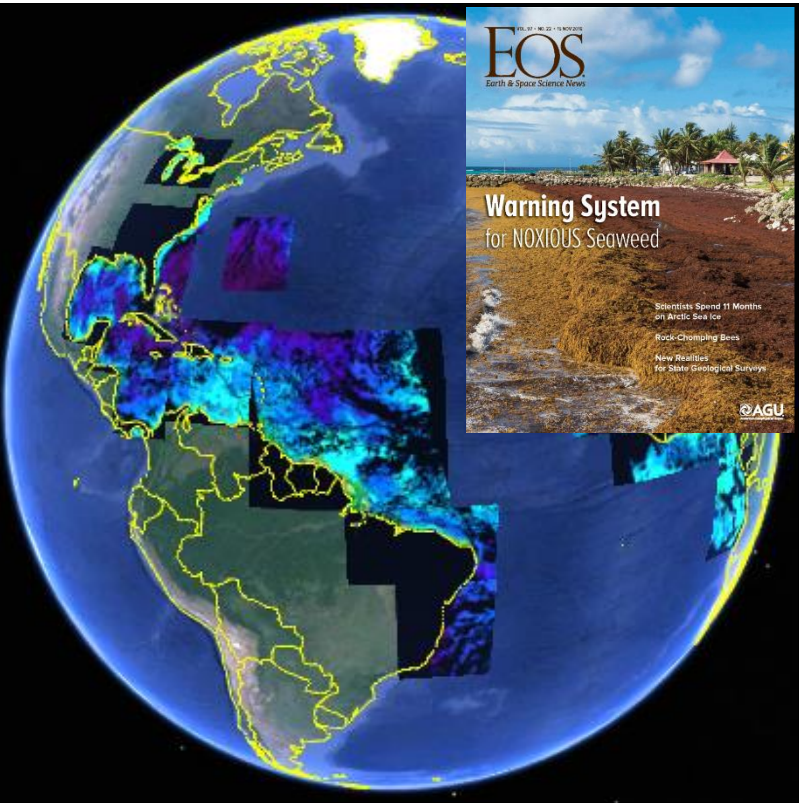
Shuai Zhang, Brian Barnes, Brock Murch, Brian Lapointe, Frank Hernandez

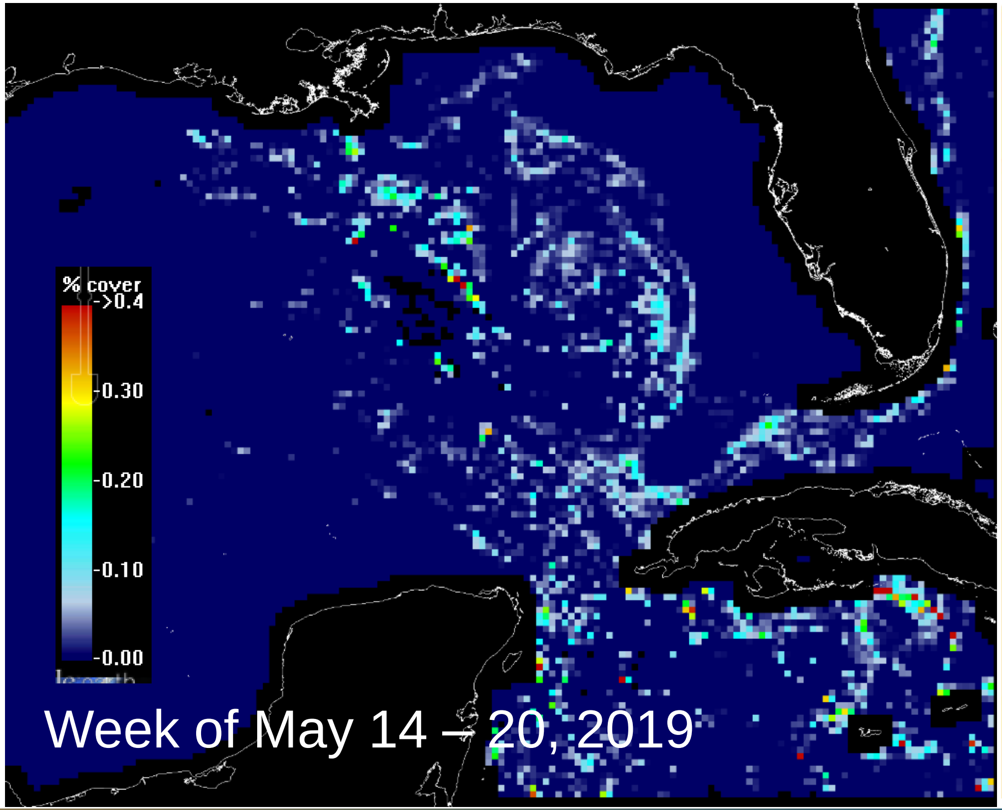
NASA Award #: NNX17AE57G; Current ARL: ~9

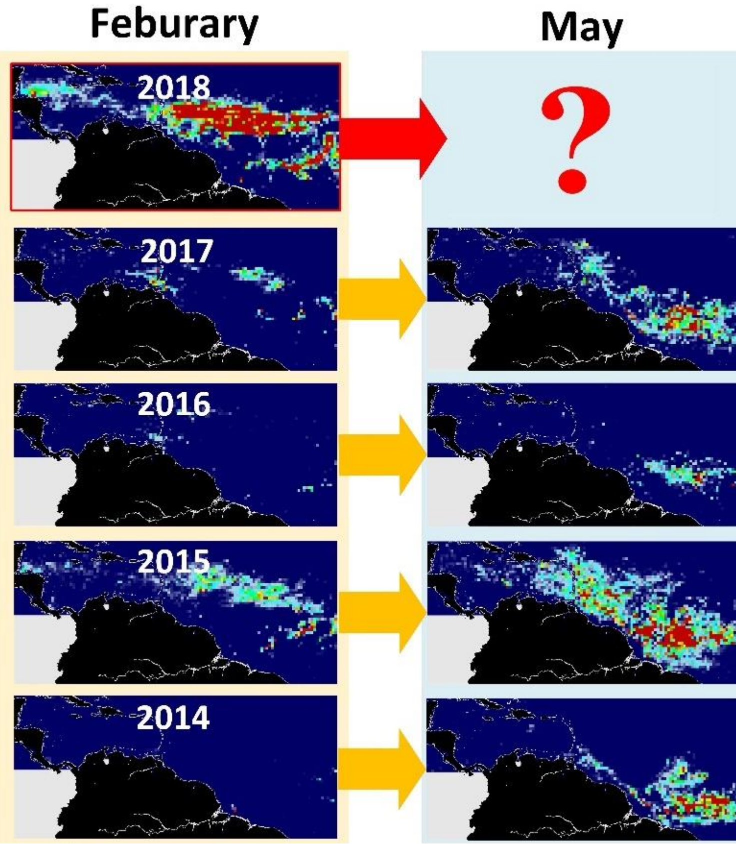
Sargassum Watch System (SaWS)

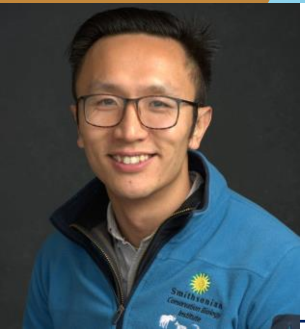
https://optics.marine.usf.edu/projects/saws.html

Monthly *Sargassum* outlook bulletins







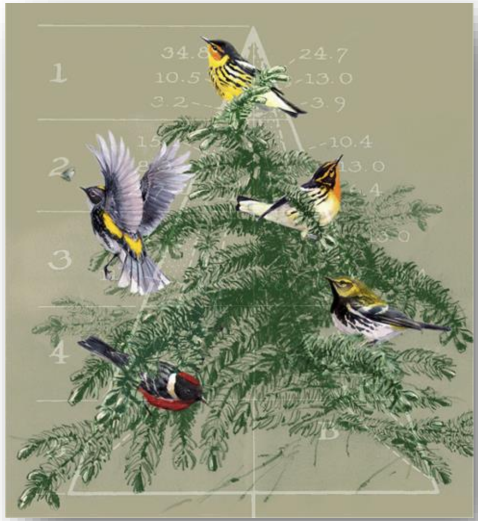


Huang–Power of GEDI: Tools to Map Habitat Heterogeneity & Biodiversity

Qiongyu Huang, Smithsonian Conservation Biology Institute

Jin Xu, Volker Radeloff

Smithsonian



Background

- Vegetation's three-dimensional (3-D) structure is a key predictor of biodiversity.
- The availability of GEDI data provides an opportunity to evaluate the importance of habitat vertical structure on biodiversity at broad scales.

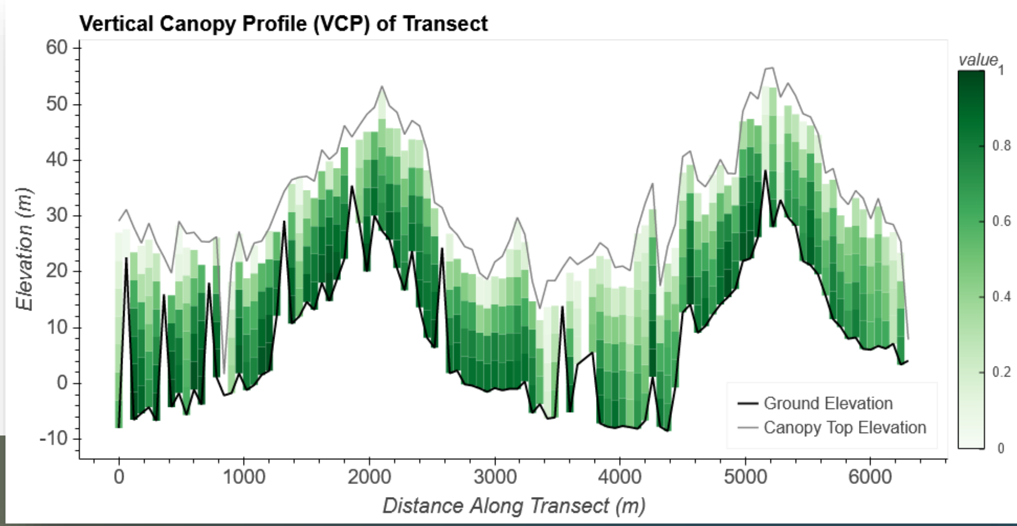
2020 New Investigator in Earth Science Program Project

Research Objectives:

*1. **Model** avian richness in Western Hemisphere (BBS & eBird datasets).*

*2. **Produce** novel habitat heterogeneity products with global coverage.*

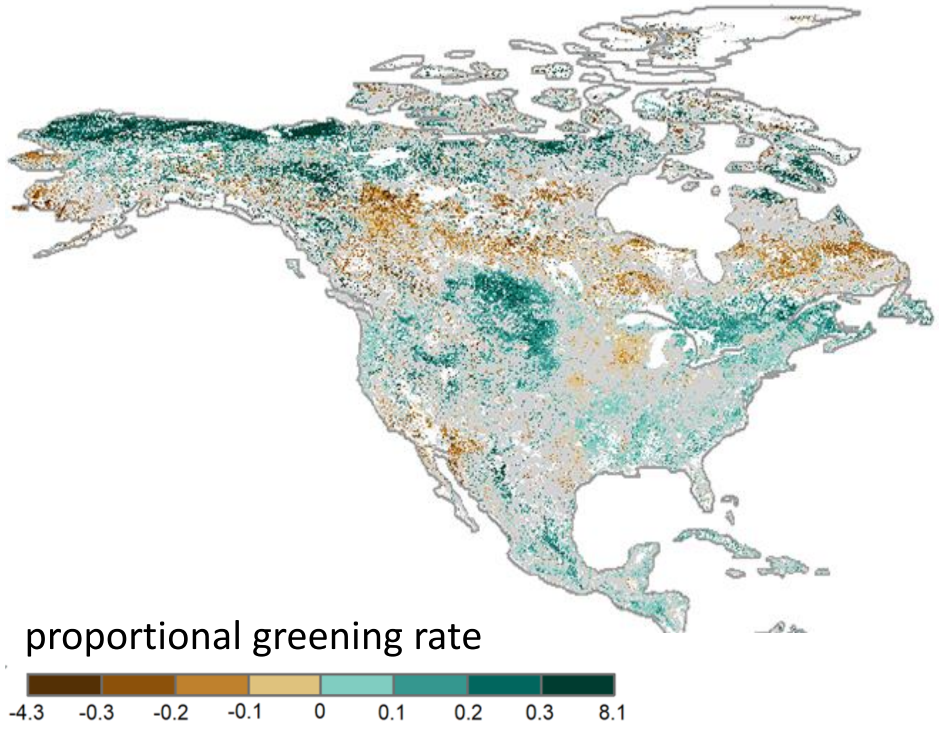
*3. **Examine** model efficacies in explaining global bird, amphibian, and mammal richness with and without the novel heterogeneity metrics.*



Ives–Statistical inference for remote-sensing data

Anthony Ives, UW-Madison
Volker Radeloff, Fangfang Wang, Jun Zhu

Trends in greening, 1982-2015, from NDVI3g



Is North America greening faster at higher latitudes?

This is inherently a statistical question posed about the processes underlying greening.

The question can only be answered using all of the pixels on the map together.

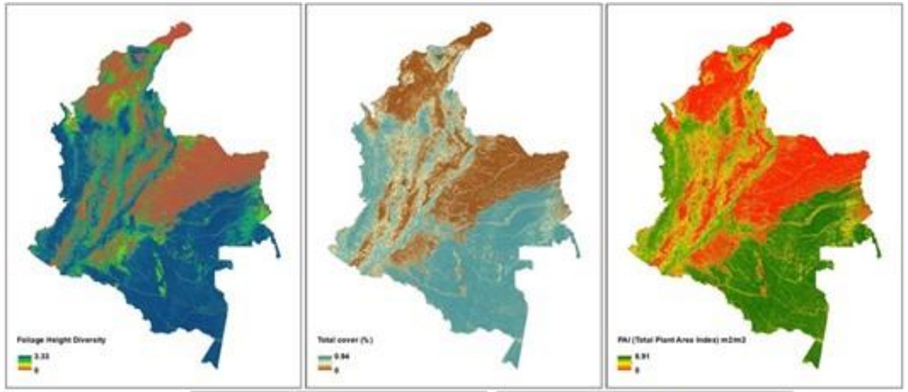
The statistical analysis must factor out patterns that are not directly attributable to latitude (clusters of greening within the same latitude).

The statistical answer is no ($P = 0.75$).

Jantz–Lidar Mapping of Forest Vertical Structure In Colombia

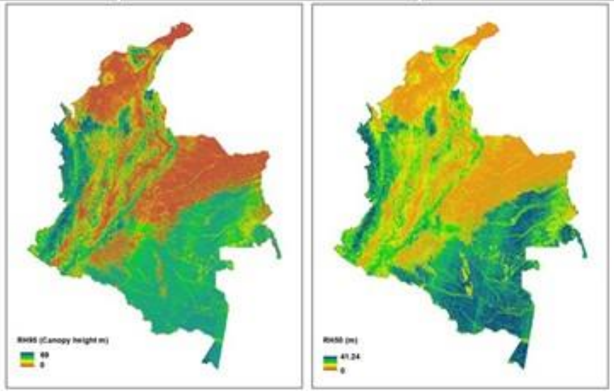
Patrick Jantz, School of Informatics, Computing, and Cyber Systems, Northern Arizona University
Scott Goetz (NAU), Camilo Fagua (NAU), Ivan Gonzalez (NAU), Susana Buritica (Humboldt), Maria Londono (Humboldt), Ralph Dubayah (UMD), Hao Tang (NU Singapore), Nicolás Castaño Arboleda (SINCHI), Dairon Lopez (SINCHI)

1. Overview - We worked with the Humboldt Institute and SINCHI (Amazonian Scientific Research Institute) to use Global Ecosystem Dynamics Investigation (GEDI) and aircraft lidar to map forest structure in Colombia and develop empirical relationships between tree diversity and forest structure for biodiversity mapping and monitoring.
2. Outreach
    1. Y1 - workshop presenting lidar concepts and code to process lidar data
    2. Y4 – contributed material to a graduate class, Spatial Analysis of Environmental Data, taught by C. Fagua (ad honorem) at Universidad Nacional de Colombia (in progress, October 21 – end of January 22).
3. Decision Support
    1. Shared forest structure datasets to support collaborative eBird-Humboldt effort to map bird diversity in Caribe, Andes, and Choco regions.
    2. Co-generating forest structure and tree diversity maps with SINCHI to inform biodiversity priorities in the Colombian Amazon.



Instituto SINCHI

INSTITUTO HUMBOLDT COLOMBIA

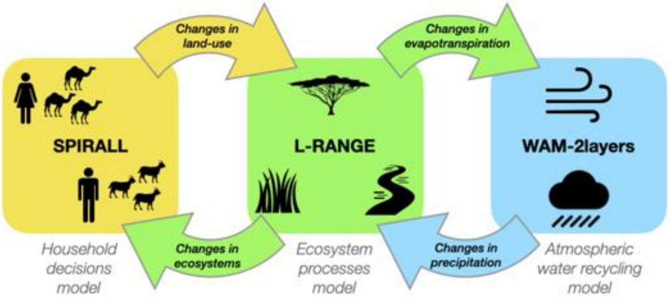


4. Publications
    1. Fagua, J.C., Jantz, P., Burns, P., Massey, R., Buitrago, J.Y., Saatchi, S., Hakkenberg, C. and Goetz, S.J., 2021. Mapping tree diversity in the tropical forest region of Chocó-Colombia. *Environmental Research Letters*, *16*(5), p.054024.
    2. Fagua, J.C., Jantz, P., Rodriguez-Buritica, S., Duncanson, L. and Goetz, S.J., 2019. Integrating LiDAR, Multispectral and SAR Data to Estimate and Map Canopy Height in Tropical Forests. Remote Sensing, 11(22), p.2697.

Keys–Cross-scale dynamics of SDG achievement in Kenya

Patrick Keys, *School of Global Environmental Sustainability, Colorado State University*
With collaborators: Rekha Warrier, Randall Boone, and Kathleen Galvin

1 Update progress on coupled modeling of SDG#15 (using *new* agent-based model ‘SPIRALL’, ecosystem model ‘L-Range’, and moisture tracking model, WAM-2layers)



2 Development of new Human Footprint Index using machine-learning (ml-HFI), with applications for SDG#15

3 New initiative to co-design SDG-relevant project applications with Kenyan partner, SEI-Africa

SEI


https://www.flickr.com/photos/37129284@N02/3828356031

Kiefer–Tunascape: Ocean Circulation and the ETPO Tuna Fishery

Dale Kiefer, Z. Siegrist, F. O'Brien, (System Science Applications), A. Bakun (U. of Miami), D. Menemenlis (JPL), Manfredi Manizza (SIO), D. Bianchi (UCLA)

During my poster session, I will present findings of how the Equatorial, Equatorial Counter, and North Equatorial currents shape the distribution of the skipjack, yellowfin, and bigeye tuna caught by the purse seine fishery of the Eastern Tropical Pacific Ocean. These findings are largely based upon matching in time and space fisheries data with satellite imagery of sea surface temperature, chlorophyll, and height as well as simulations with NASA's ECCO-Darwin biogeochemical model. To analyze such imagery, we have built algorithms to release and track drifters to trace water movement as well as algorithms to map mesoscale vorticity and convergent and divergent flow.

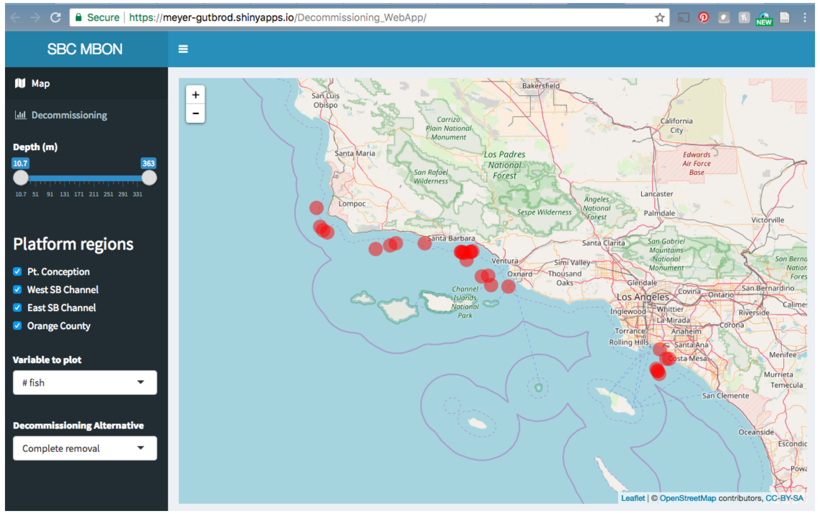
I will also demonstrate our TunaScape geographical information system that provides tools of data integration and analysis to speed the process of defining species habitat and then mapping a species distribution. These tools may aid your own research, since they can be applied to a broad range of ecological studies.

Miller–Southern California Bight Marine Biodiversity Observation Network

Robert Miller, University of California Santa Barbara
Robert Miller, David Siegel, Craig Carlson, Daniel Reed, BS Manjunath, Deborah Iglesias-Rodriguez, Doug McCauley, Milton Love, Andrew Rassweiler, Kevin Lafferty, Andrew Thompson

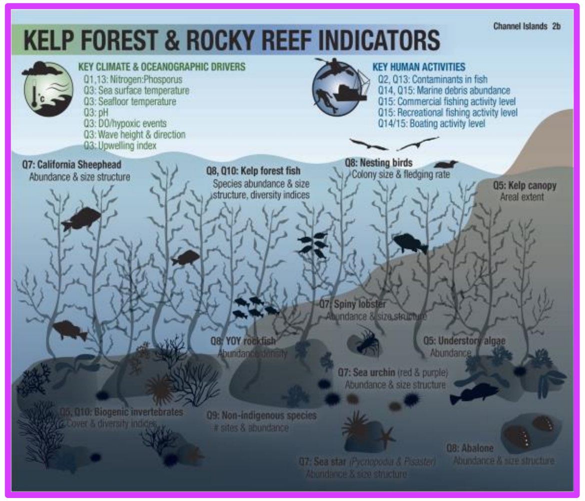
SCB MBON Goal:

Provide data and products to inform managers and society about patterns of marine biodiversity across taxa, space, and time



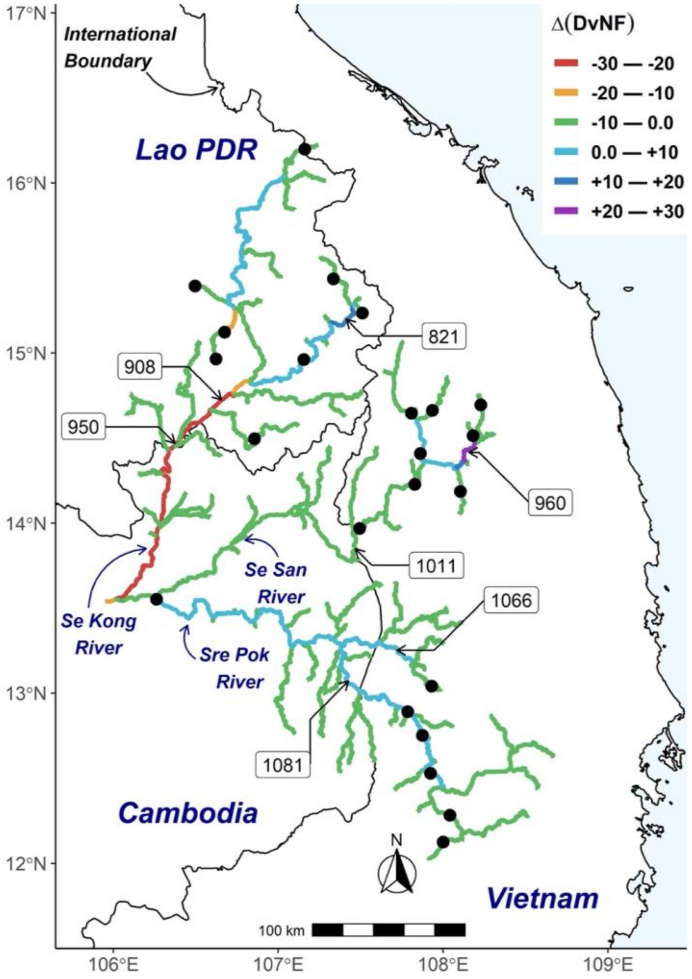
Approach:

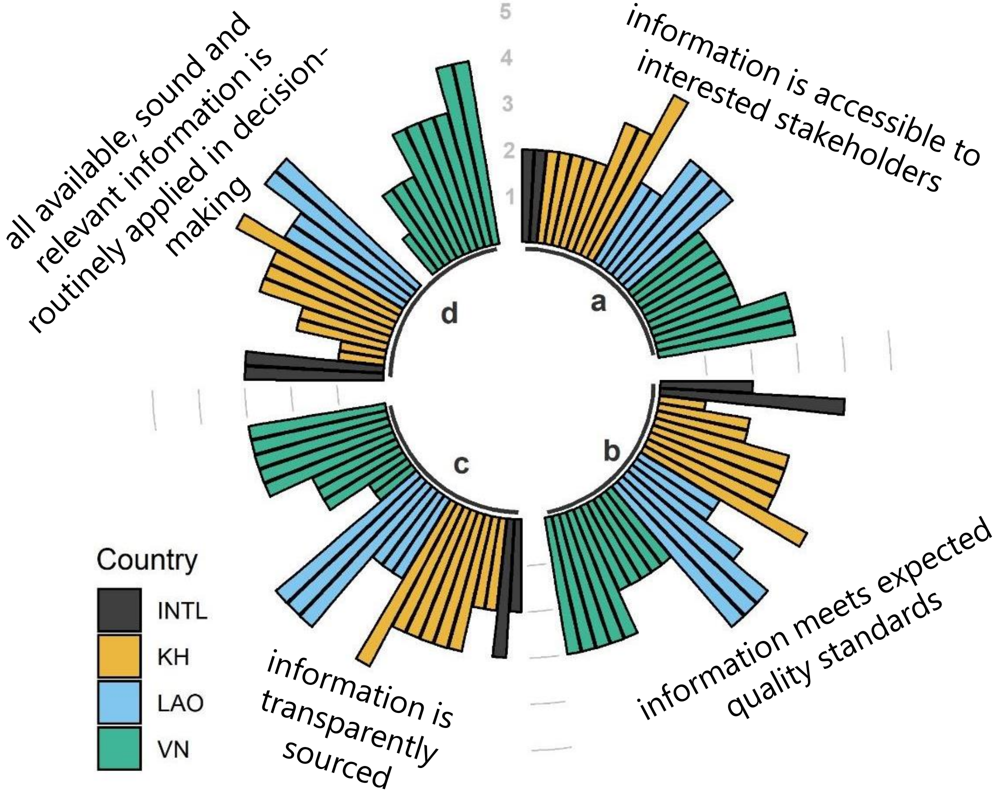
- *Integrate existing data*
- *Develop new methods & products*



Mohammed– Sustainability of the 3S Rivers under Climate Change

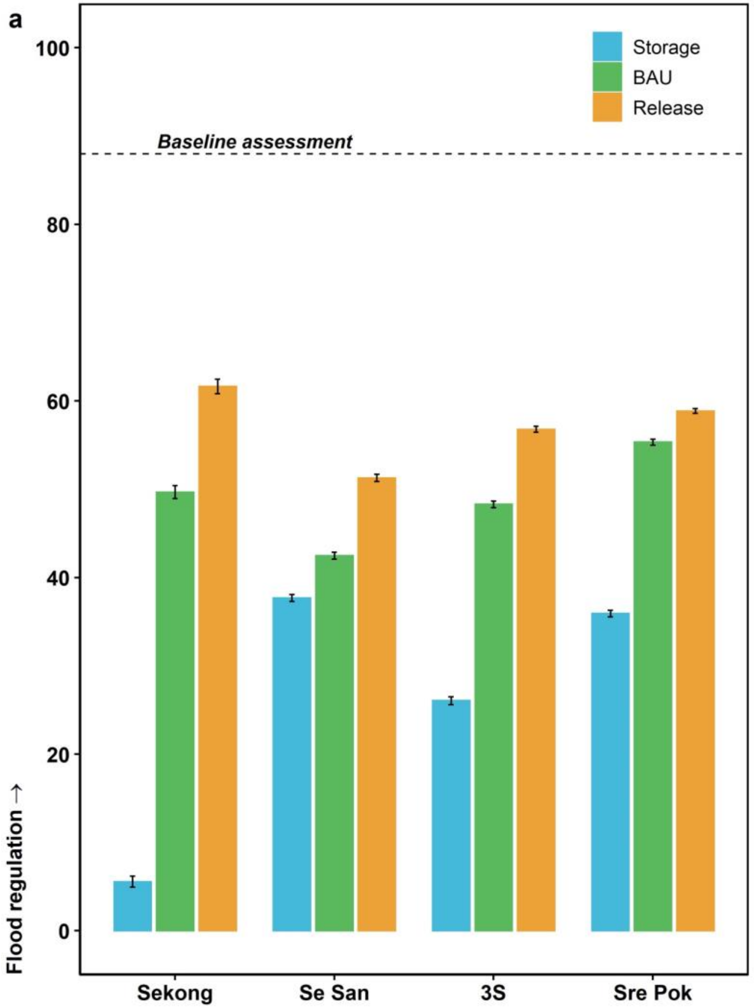
Ibrahim Mohammed, SAIC, NASA-GSFC
John Bolten, Nicholas Souter, Kashif Shaad, and Derek Vollmer





Information access and knowledge questionnaire responses

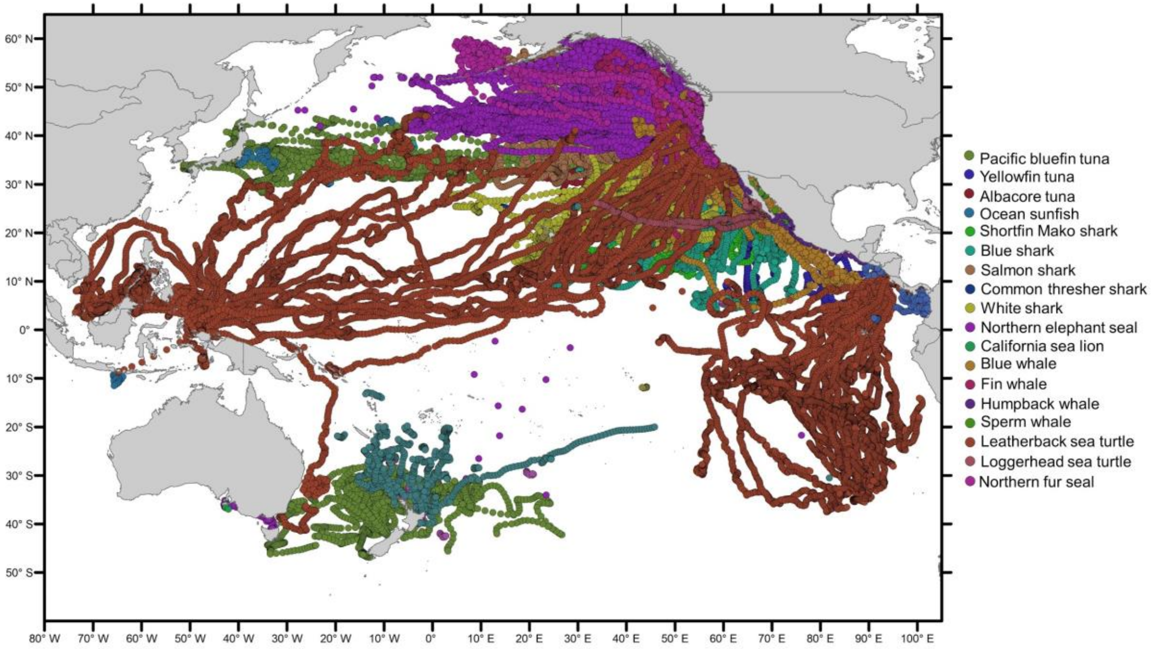
Rating	Criteria
1	Almost never satisfactory
2	Rarely satisfactory
3	Sometimes (~50%) satisfactory
4	Often satisfactory
5	Almost always satisfactory

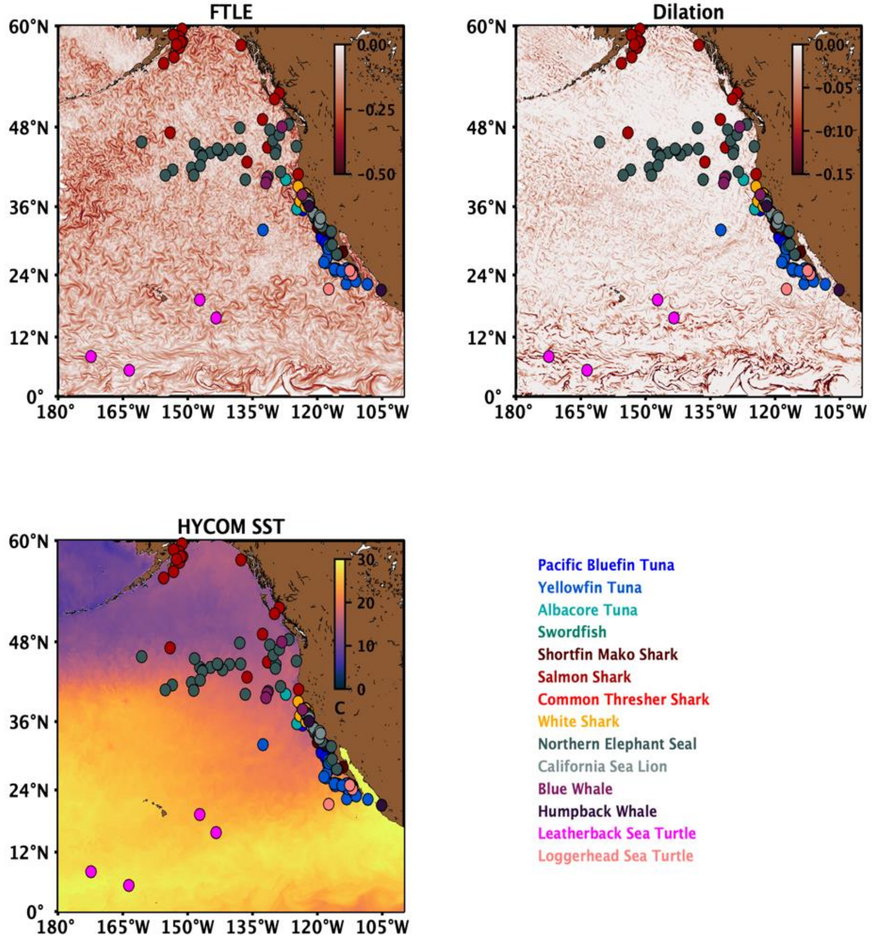


Oliver–Scaling of Environmental Selection in Pelagic Species

Matt Oliver, University of Delaware
Aaron Carlisle and Jerome Pinti, University of Delaware
Helga Huntly, Rowan University

Organismal physiology and size determines the scales that pelagic predators associate with dynamic ocean features





Peery–Enhancing biodiversity & resilience in dry forests

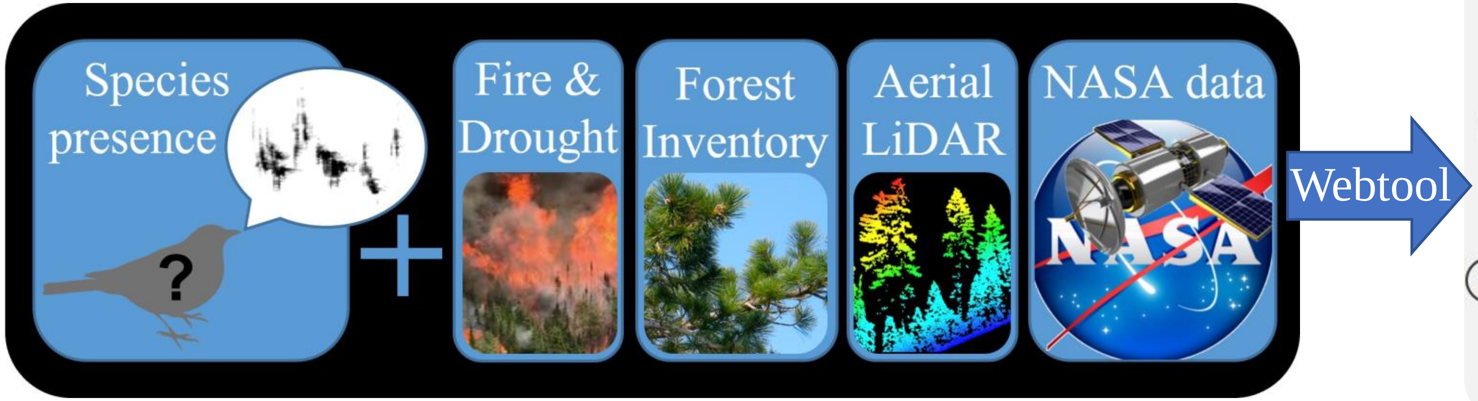
M. Zach Peery, University of Wisconsin, Madison

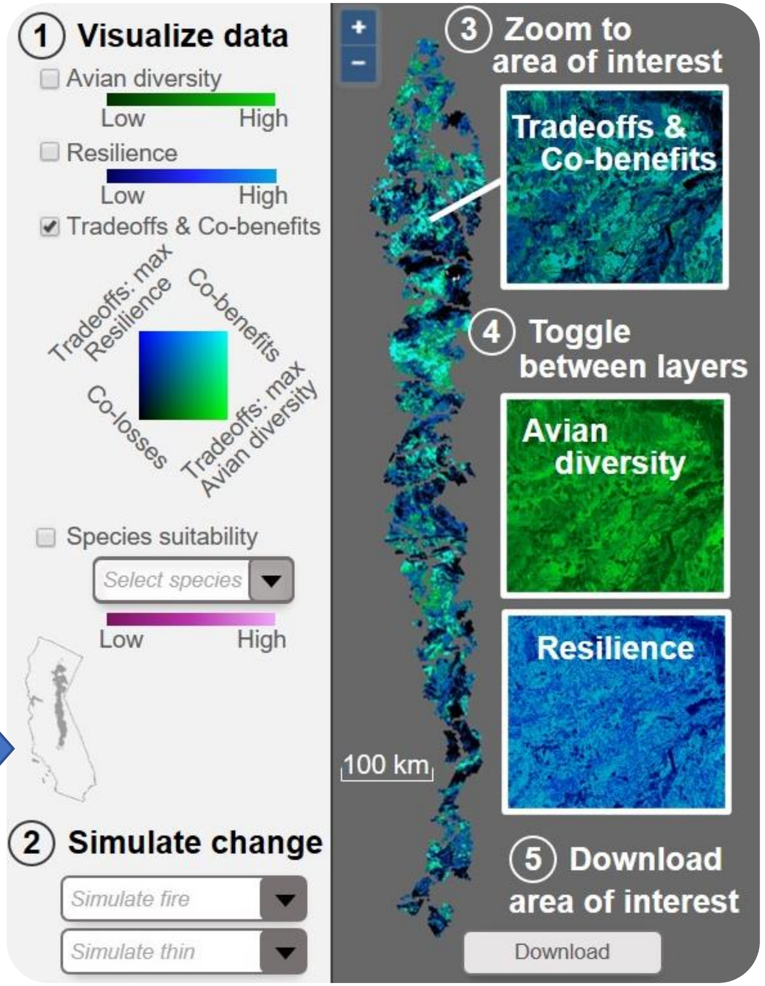
Van Kane & Alina Cansler, U. of Washington; Sarah Sawyer, John Keane, Malcolm North USFS – R5;

Zuzana Burivalova & Anu Kramer, U. of Wisconsin, Madison; Connor Wood, Cornell Lab of Ornithology

To enhance biodiversity conservation in rapidly changing Sierra Nevada forests, we will:

- Develop bioacoustics-based measures of avian community diversity
- Model habitat suitability and assess protected area outcomes
- Build webtool predicting effect of forest restoration on avian diversity





Pijanowski - Multi-Sensor Biodiversity Framework

Bryan C. Pijanowski, PI,Purdue University
Jinha Jung, co-I, Purdue University; Jingjing Liang, co-I, Purdue University

Temperate Forest (Tippecanoe)

Miombo Woodland (Tanzania)

Mangroves (Bangladesh)

Forest-Steppe (Mongolia)

- GEDI, DESIS, ECOSTRESS
- MODIS, Landsat, ICESat
- Acoustic Sensors
- "Silent" data:
  - Field Surveys
  - Forest Inventories
  - UAV
  - Weather Stations

ACOUSTIC INDICES

VEGETATION INDICES

3D LIDAR

T-SNE

Multi-spectral Imagery

LOESS

TIMESAT

ARIMA

CNN

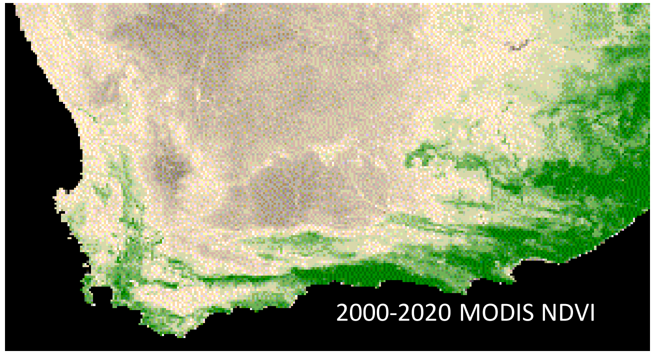
SVM

Multi-sensor Biodiversity Modeling Framework

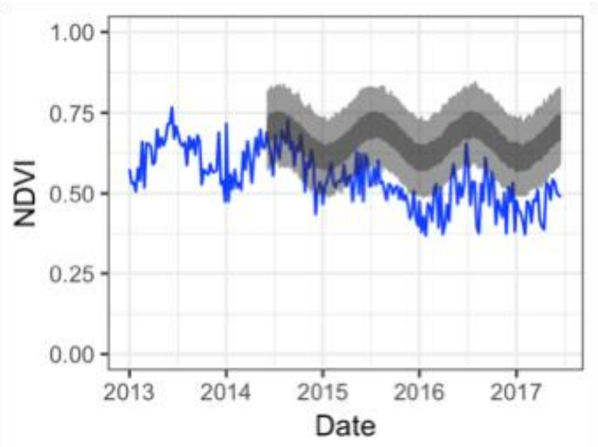
Wilson – Forecasting and Change Detection in a Biodiversity Hotspot

Adam M. Wilson, University at Buffalo
Yingjie Hu, Jasper A. Slingsby, Glenn R. Moncrieff, & Jeremy Malczyk

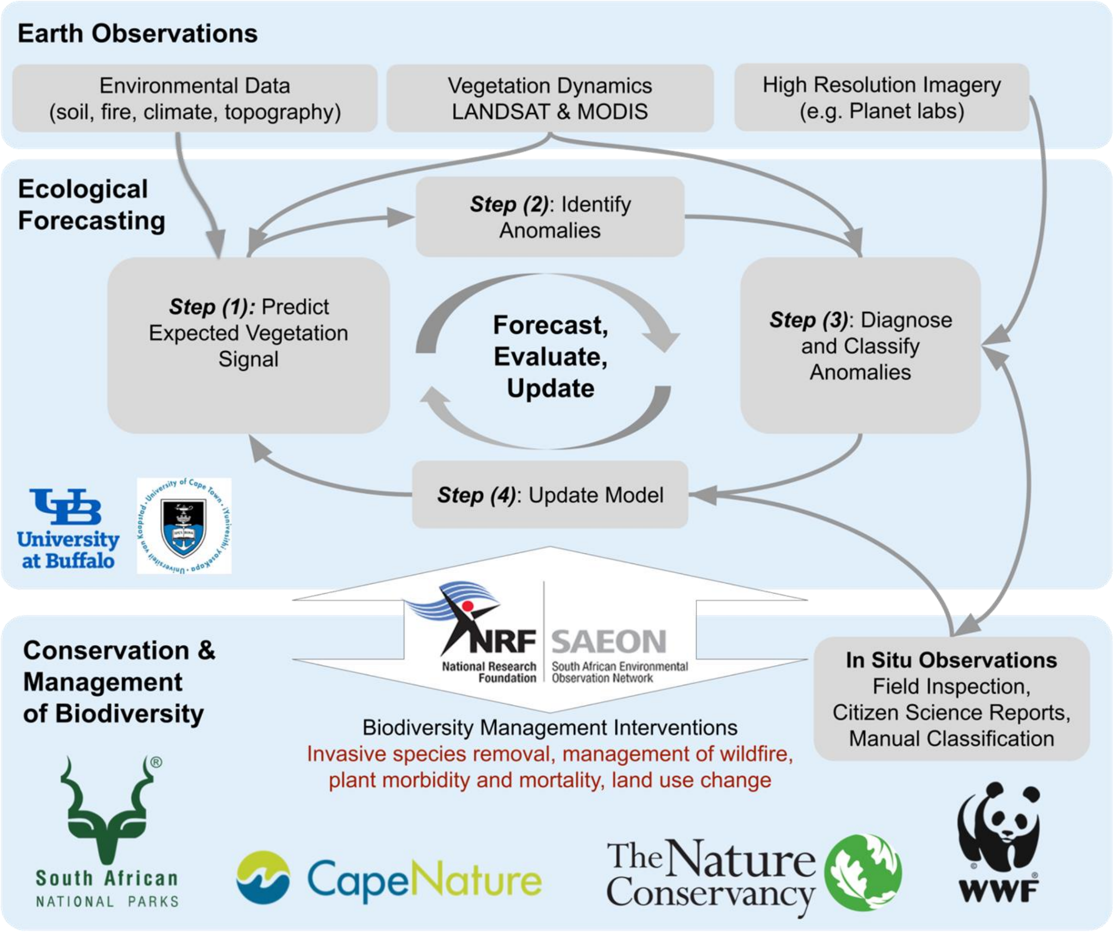
Many ecosystems experience significant seasonal and interannual variability (fire, drought, etc.)



How to identify *change* in these dynamic systems?



Use Bayes & AI to detect unusual events



Check out emma.eco for more

Wright – Ecosystem mapping in West Papua

Timothy Max Wright, Conservation International
Daniel Juhn, Conservation International

The poster will describe the SEEA compliant methods used to map ecosystem extent in West Papua, Indonesia and how ecosystem-based planning can support green development. The results of the ecosystem extent map will be compared with other methods for modeling biodiversity to highlight advantages and disadvantages. Finally, there will be an example of how ecosystem-based planning can be used to support provincial conservation priority setting.

Chaplin–Essential Biodiversity Variables & Ecosystem Services

Becky Chaplin-Kramer[1,2,3], Jeffrey Smith[1,2], Rafael Schmitt[1,2], Alejandra Echeverri[1,2], Kelley Langhans[1,2], Chris Anderson[2], Jesse Goldstein[1,2], Lingling Liu[1,2,3], Gretchen Daily[1,2], Rafa Monge Vargas[4], Irene Alvarado Quesada[5], Cornelia Miller[6]

[1]Natural Capital Project, [2]Stanford University, [3]University of Minnesota, [4]Costa Rica Ministry of Environment & Energy, [5]Central Bank of Costa Rica, [6]PRIAS Lab

GEO BON
Group on Earth Observations Biodiversity Observation Network

Essential Biodiversity Variables (EBVs):
Genetic
Species population
Species traits
Community composition
Ecosystem structure
Ecosystem function

Essential Ecosystem Service Variables (EESVs):
Supply
Demand
Use
Anthro. contributions
Instrumental
Relational

Data sources

MODIS/Landsat EVI
C factor
EFT
Sediment retention
Pollination
DEM, Soil data
IMN LULC
Climate data
PRIAS/ iCAFE crop map
Pollinator relative abundance
GBIF species occurrence
Species Distribution Models
Vertebrate abundance/richness
Nature-based tourism
Roads, hotels, human footprint data

Analyses

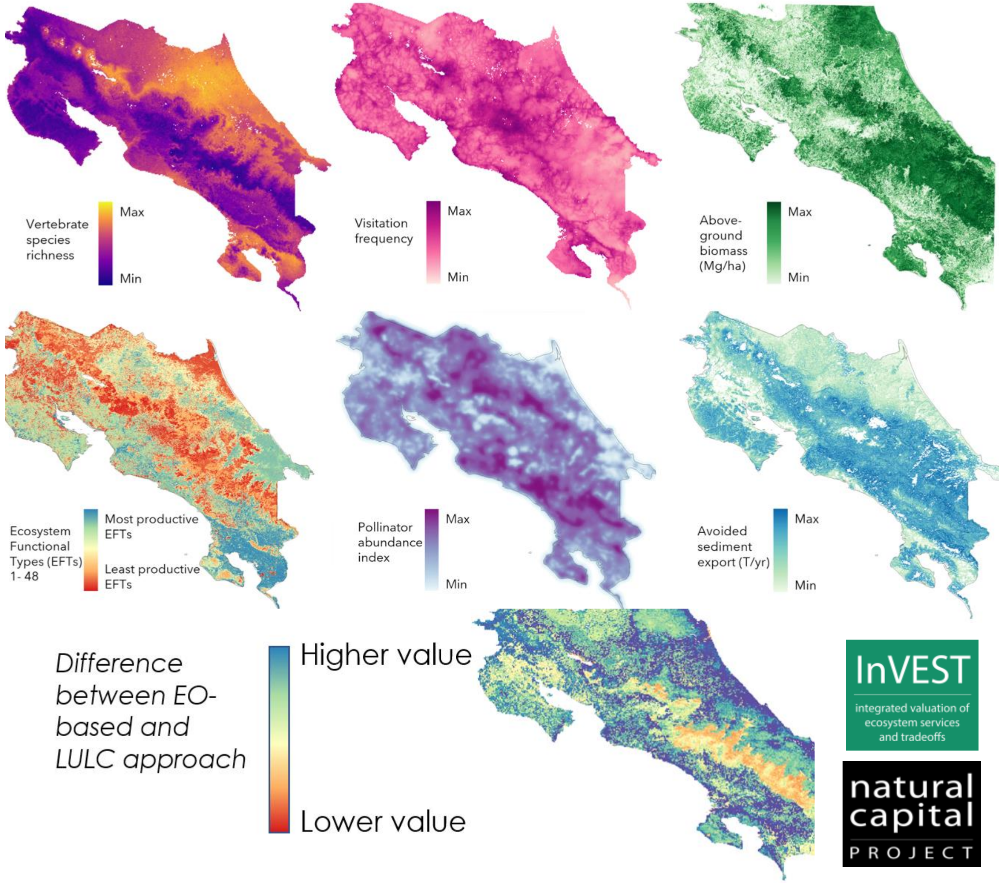
Mapping ES, overlap/hotspots
Summarizing total ES, by ecosystem type/ admin boundary
Evaluating change in ES over time
Scenario analysis of restoration opportunities / conservation priorities
Developing monitoring plans/ priorities

Decision-support

UNDP Essential Life Support Areas
National Adaptation Plan
SEEA National Accounts
State of the Environment Report
CBD Global Biodiversity Framework
CBD Biodiversity Strategy & Action Plan
National PES Reboot: PSA 2.0
SDG indicators

End users

Costa Rica Gobierno del Bicentenario 2018-2022
BCCR Banco Central de Costa Rica
PRIAS
MINAE Ministerio de Ambiente y Energía
CENIGA Centro Nacional de Información Geoambiental
SINIA Sistema Nacional de Información Ambiental
SIMOCUTE
ice
Icafe Instituto del Café de Costa Rica
BIOFIN
SEEA
UNDP



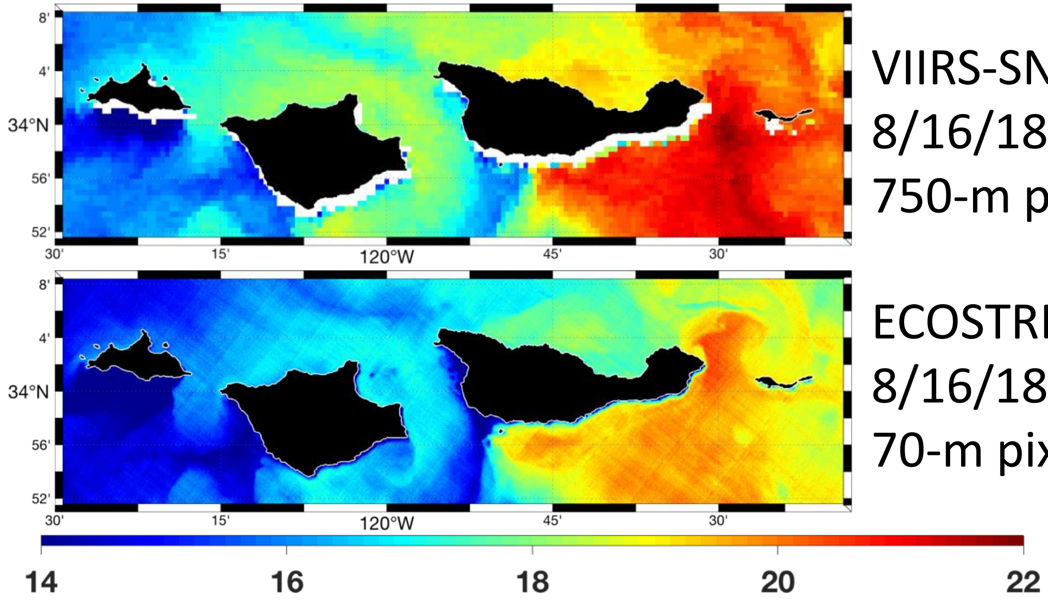
InVEST integrated valuation of ecosystem services and tradeoffs
natural capital PROJECT

Otis–Coastal Surface Temperatures using ECOSTRESS

Daniel Otis, University of South Florida
Frank Muller-Karger, University of South Florida

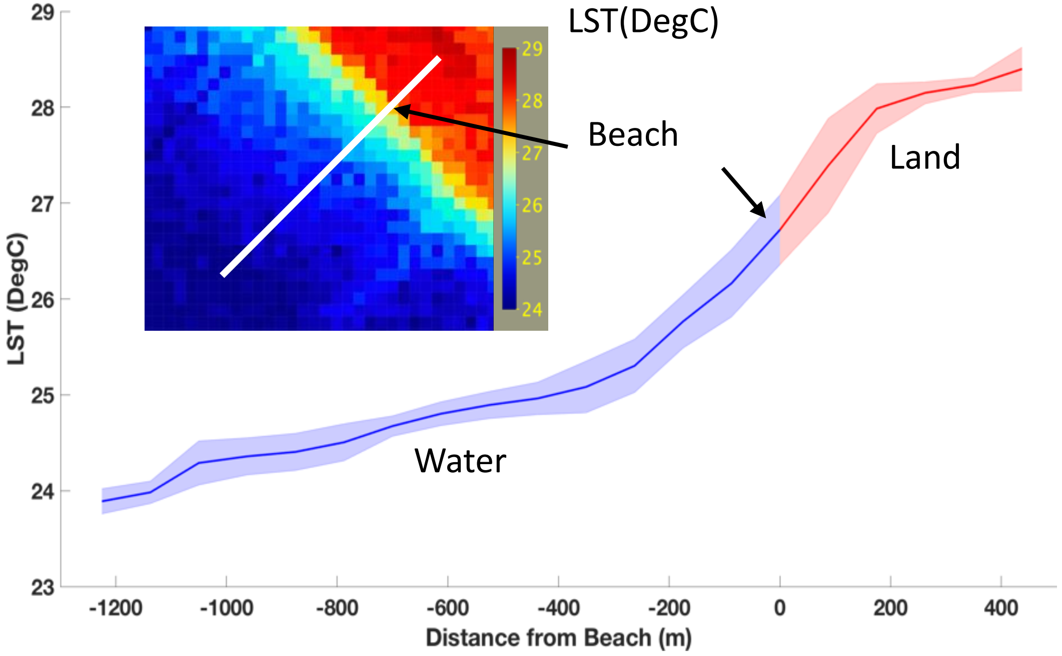
Motivation to use ECOSTRESS near the coast

- High spatial resolution (70m)
- Non-uniform sampling and re-visit times
- Ability to extract data at the water-land interface



VIIRS-SNPP
8/16/18 10:00 GMT
750-m pixel

ECOSTRESS
8/16/18 13:04 GMT
70-m pixel



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